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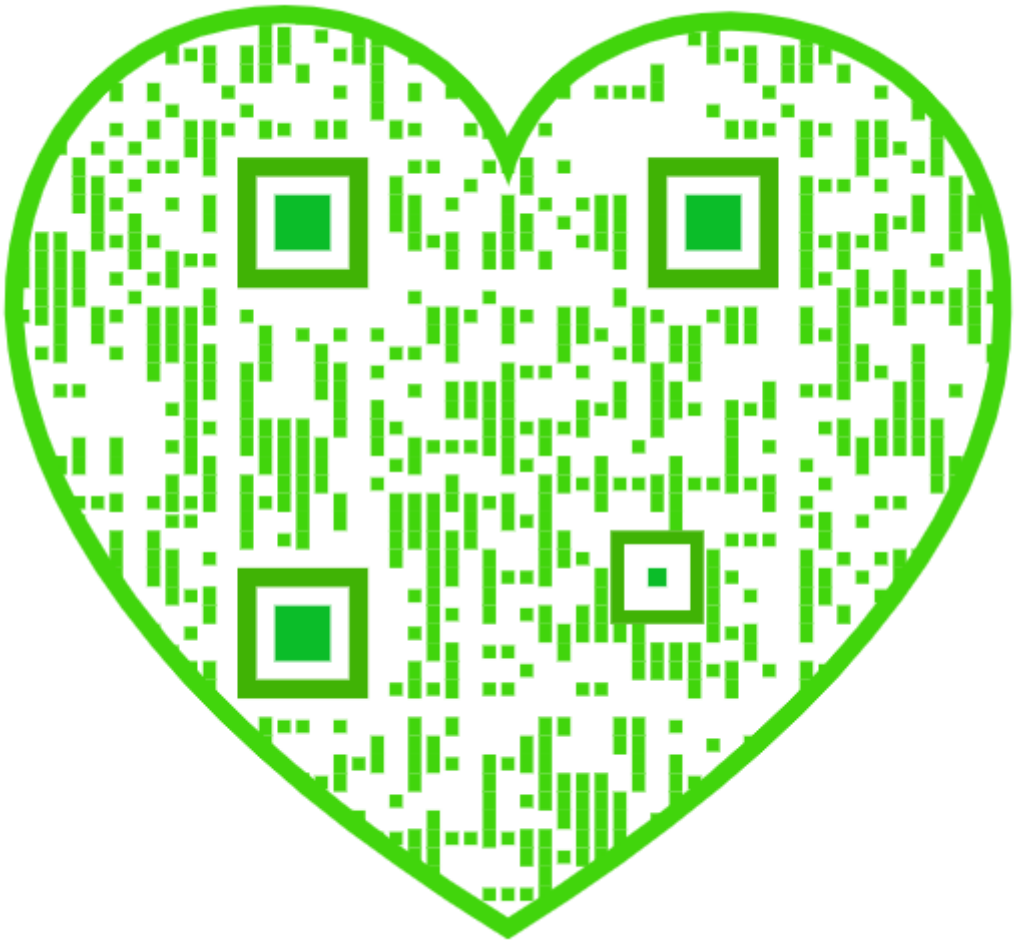
CHEMISTRY APPLIED TO PRACTICAL FARMING AND HOME MIXING FERTILIZERS



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CHEMISTRY
APPLIED TO PRACTICAL FARMING AND HOME MIXING FERTILIZERS

BY
G. I. SMITH
COATS, N. C.

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PREFACE.

The intention of the author of this book is to put into the hands of students and farmers a work which is thoroughly practical. The contents of soil, elements, materials and acids are clearly defined. The home mixing of fertilizers depends upon our knowledge of compounding fertilizer materials for the need of plants. Home mixing enables the farmer to buy fertilizers for less money and to supply different plants with food as they need it.

It is poor economy to use a fertilizer which is low in analysis and one which contains an acid not neutralized. All farmers should learn to remove the acid conditions of their soils and keep them in a feebly alkaline state by using lime.

Lime is used to counteract acid and to destroy harmful bacteria. Nitrate-forming bacteria cannot thrive successfully in acid soils. Well drained soils, supplied with humus, always produce good crops.

The acre formulas in this book may be used at different periods during the cultivation of the crop or may be used broadcast.

The tonnage formulas show the analysis, cost and application of same.

Fertilizer materials for making fertilizers are subject to fluctuate. The cost of a ton of fertilizer named in this book means cash, delivered by the dealer. Farmers should grow less cotton and tobacco and grow more food products. Stock your farm with thoroughbred animals, grow legume crops and pay cash for your fertilizers which contain phosphorous and potash.

G. I. SMITH.

Coats, N. C.

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LIST OF ELEMENTS AND THEIR SYMBOLS USED IN THIS WORK

Aluminum	Ab.
Calcium	Ca.
Carbon	C.
Chlorine	Cl.
Hydrogene	H.
Iodine	I.
Iron	Fe.
Lithium	Li.
Magnesium	Mg.
Manganese	Ma.
Nitrogen	N.
Oxygen	O.
Phosphorous	P.
Potassium	K.
Silicon	Si.
Sodium	Na.
Sulphur	S.

MR. D. J. THOMAS, of Carthage, N. C., an interested farmer, calls on the author of this book and asks the following questions :

(*Q*) What causes my young peas to turn yellow and die?

(*Q*) Why do my peas refuse to bloom?

(*Q*) How can I manage to grow a good crop of nodules on the roots of my peas?

(*Q*) How can I manage to grow a good crop of crimson clover on poor sandy soils?

(*Q*) Is a pound of nodules grown on cow peas worth any more than a pound grown on crimson clover?

(*Q*) How many pounds of 98% lime carbonate are required to counteract the acid in 600 pounds in acid phosphate?

(*Q*) How can I use Farmogerm successfully?

All these questions were answered promptly.

Mr. Thomas took the advice. He no longer has any trouble growing these legume crops profitably.

SOIL.

Lesson 2.

(*Q*) What is soil?

(*A*) Soil is a composition of iron, phosphorous, potassium, calcium, magnesium, sulphur, sodium, chlorine, silicon, manganese, aluminum, iodine and lithium.

(*Q*) What is iron?

(*A*) Iron is one of the metallic elements.

(*Q*) What is phosphorous?

(*A*) Phosphorous is an elementary substance of a yellowish color, resembling fine wax. It is found in all decayed matter and in the phosphate rocks.

(*Q*) What is potassium?

(*A*) Potassium is a bluish-white, lustrous metal, having a strong affinity for oxygen. It is the basis of potash.

(*Q*) What is calcium?

(*A*) Calcium is the metallic basis of lime.

(*Q*) What is magnesium?

(*A*) Magnesium is the undecomposable metallic base of magnesia.

(*Q*) What is sulphur?

(*A*) Sulphur is a mineral substance of a yellowish color, brittle and insoluble in water.

SOIL.

Lesson 3.

(*Q*) What is sodium?

(*A*) Sodium is a yellowish-white, metallic element, soft like wax and lighter than water.

(*Q*) What is chlorine?

(*A*) Chlorine is an elementary substance; a heavy gas of greenish color.

(*Q*) What is silicon?

(*A*) Silicon is a dark nut-brown elementary substance, destitute of metallic luster. It is the base of silica.

(*Q*) What is manganese?

(*A*) Manganese is a metal of a whitish-gray color and difficult to fuse.

(*Q*) What is aluminum?

(*A*) Aluminum is the metallic base of alumana.

(*Q*) What is iodine?

(*A*) Iodine is a grayish or bluish-black substance of metallic luster, resembling plumbago. It is obtained from the ashes of sea-weed, usually in the form of crystals.

(*Q*) What is lithium?

(*A*) Lithium is an alkali mineral.

ELEMENTS.

Lesson 4.

(*Q*) What is carbon?

(*A*) Carbon is an elementary substance which predominates in all organic compounds.

(*Q*) What is hydrogen?

(*A*) Hydrogen is an inflammable, colorless gas of extreme lightness. It enters as an element into the composition of nearly all organic bodies.

(*Q*) What is oxygen?

(*A*) Oxygen is a gaseous element destitute of taste, color and smell in its ordinary condition. It serves to support life and forms about twenty-two per cent. of the atmosphere.

(*Q*) What is nitrogen?

(*A*) Nitrogen is a gaseous element without taste, odor or color, forming about four-fifths of common air.

(*Q*) What is water?

(*A*) Water is a compound of hydrogen and oxygen.

(*Q*) What does water absorb?

(*A*) Water, when exposed to the air, absorbs oxygen and nitrogen.

(*Q*) What is an alkali?

(*A*) An alkali is an element or substance which neutralizes any acid.

(*Q*) What is ammonia?

(*A*) Ammonia is an alkali in its uncombined state. It is a compound of hydrogen and nitrogen.

ELEMENTS.

Lesson 5.

(*Q*) What is an oxide?

(*A*) An oxide is a compound of oxygen and a base destitute of an acid.

(*Q*) What is caustic?

(*A*) Caustic, with reference to lime, means an element which burns, corrodes or destroys the texture in combination with another element.

(*Q*) What is humus?

(*A*) Humus is a composition of decayed vegetable matter.

(*Q*) How many forms of humus are there?

(*A*) There are two forms of humus: (1) mild form, which contains ammonia, lime and magnesia; (2) sour form, which contains no property favorable to vegetation and indicates a want of lime.

(*Q*) What is organic plant food?

(*A*) Organic plant food is any plant food which is obtained from decayed animal or vegetable matter.

(*Q*) What is inorganic plant food?

(*A*) Inorganic plant food means any plant food obtained from a mineral source.

(*Q*) What are the three most important plant foods?

(*A*) The three most important plant foods are phosphorous, potash and nitrogen.

MATERIALS.

Lesson 6.

(*Q*) What is acid phosphate?

(*A*) Acid phosphate is a composition of calcium phosphate or phosphate rock treated with sulphuric acid. It contains from 12 to 16 per cent. available phosphoric acid.

(*Q*) What is Tennessee rock?

(*A*) Tennessee rock is calcium phosphate or phosphate rock finely ground, containing phosphorous from 26 to 32 per cent. Less than 2 per cent. of it is available.

(*Q*) How does the phosphorous in the Tennessee rock become available after it is applied to the soil?

(*A*) It becomes available when it is applied to the soil as it comes in contact with nitric acid.

(*Q*) How does the phosphorous in cotton seed meal, fish guano, tankage, bone meal, raw cotton seed, stable manure and all decayed matter become available?

(*A*) The phosphorous in all these materials or substances becomes available as it comes in contact with nitric acid in the soil.

(*Q*) What is tankage?

(*A*) Tankage is a by-product of the slaughter houses. It contains from 8 to 10 per cent. ammonia and from 3 to 6½ per cent. phosphoric acid. The best grades of it are imported to this country from South America and England.

(*Q*) What is fish guano?

(*A*) Fish guano is a by-product of the fish oil mills. It contains from 3 to 6 per cent. phosphoric acid and from 8 to 10 per cent. ammonia. Best grades of it are imported from England. It is made in the United States.

MATERIALS.

Lesson 7.

(*Q*) What is cotton seed meal?

(*A*) Cotton seed meal is a by-product of the cotton seed oil mills. It contains about 2½ per cent. phosphoric acid, 7½ per cent. ammonia and 1½ per cent. potash.

(*Q*) What is castor pomace?

(*A*) Castor pomace is a by-product of the seed oil mills. It is the by-product of the castor bean. It contains 1½ per cent. phosphoric acid, 8 per cent. ammonia and 1½ per cent. potash. It is made in the United States, England and China.

(*Q*) What is dried blood?

(*A*) Dried blood is a by-product of the slaughter houses. It contains from 12 to 17 per cent. ammonia. Best grades of it are imported to this country from South America and England. It is also made in the United States.

(*Q*) What is nitrate of soda?

(*A*) Nitrate of soda is a mineral dug from the ground in Chile and Peru. It contains nitrogen in the form of a crystal. It is imported to this country from South America.

(*Q*) What is sulphate of ammonia?

(*A*) Sulphate of ammonia is a product obtained by the distillation of bone black for sugar refiners and from the ammoniacal liquor from the gas works. It is 20 per cent. nitrogen. It is made in the United States and other countries.

(*Q*) What is bone meal?

(*A*) Bone meal or ground bone is a product obtained from grinding raw bones or dried bones. It is imported to this country from South America, and is a product of the slaughter houses of this country. It contains 4 per cent. nitrogen and 18 per cent. phosphoric acid.

(*Q*) What is dissolved bone?

(*A*) Dissolved bone is a product of the raw bone dissolved with sulphuric acid. It contains 2 per cent. nitrogen and 15 per cent. available phosphoric acid.

MATERIALS.

Lesson 8.

(*Q*) What is Thomas phosphate?

(*A*) Thomas phosphate is a composition of iron, manganese, magnesia, lime and phosphoric acid.

(*Q*) Will the phosphoric acid in Thomas phosphate revert?

(*A*) The phosphoric acid in Thomas phosphate cannot revert because it is not a super-phosphate.

(*Q*) What per cent. of Thomas phosphate is available phosphoric acid?

(*A*) Thomas phosphate runs from 14 to 20 per cent. available phosphoric acid.

(*Q*) What per cent. of Thomas phosphate is not available when applied to the soil?

(*A*) About 2 per cent. of Thomas phosphate is not available when applied to the soil.

(*Q*) How does the 2 per cent. become available after it is applied to the soil?

(*A*) The 2 per cent. becomes available after it is applied as it comes in contact with nitric acid from some material containing ammonia or nitrogen.

(*Q*) Will Thomas phosphate bring about an acid condition when it is applied to the soil?

(*A*) Thomas phosphate cannot bring about any acid condition of the soil, as it is free from sulphuric treatment and is an alkali.

(*Q*) How is the lime in Thomas phosphate obtained?

(*A*) The lime in Thomas phosphate is obtained from the Dolomitic lime-stone rock.

MATERIALS.

Lesson 9.

(*Q*) What per cent. of the lime in Thomas phosphate is in the form of calcium carbonate?

(*A*) About 95 per cent. of the lime in Thomas phosphate is in the form of calcium carbonate.

(*Q*) What per cent. of the lime in Thomas phosphate is caustic lime?

(*A*) About 5 per cent. of the lime in Thomas phosphate is caustic lime.

(*Q*) Of what value is the magnesia in Thomas phosphate?

(*A*) Magnesia is a plant food. The cotton plant is a great feeder on magnesia, hence its value as a fertilizer.

(*Q*) What value or benefit do we get from the manganese and iron in Thomas phosphate?

(*A*) The manganese and iron in Thomas phosphate furnish the chlorophyl which is essential to make the foliage of all plants green. The oxide of iron and manganese is a plant food.

(*Q*) Can Thomas phosphate be used in place of acid phosphate in mixing a regular fertilizer?

(*A*) Thomas phosphate can be mixed with cotton seed meal, fish guano, tankage, dried blood and any other materials that are commercially dry with safety.

(*Q*) Can Thomas phosphate be mixed with nitrate of soda and potash with safety?

(*A*) If you mix Thomas phosphate with nothing but potash and nitrate of soda the mixture should be used at once.

MATERIALS.

Lesson 10.

(*Q*) Can you mix 1,000 pounds of Thomas phosphate with 200 pounds nitrate of soda, 600 pounds of fish guano and 200 pounds of muriate of potash without any escape of ammonia?

(*A*) Yes, because the moisture of the nitrate of soda is consumed by the fish guano and the mixture can be made without any loss of ammonia.

(*Q*) Why does Thomas phosphate do good more than one year?

(*A*) Thomas phosphate does good more than one year because it is not water soluble. The phosphoric acid in it does not leach out. It carries a heavy per cent. of lime extra which acts as a reagent.

(*Q*) Can Thomas phosphate be used broad-cast?

(*A*) If you broad-cast Thomas phosphate (1,000 pounds per acre) you will get good results from any crop for three years if the land contains enough humus to furnish nitric acid for that period.

(*Q*) Where is Thomas phosphate made?

(*A*) It is made in England, France and Germany. It is imported to the United States by various importers.

(*Q*) What is the analysis of Thomas phosphate?

(*A*) Thomas phosphate contains from 16 to 22 per cent. phosphate acid, from 35 to 50 per cent. lime, from 13 to 14 per cent. iron, from 8 to 9 per cent. manganese, from 5 to 6 per cent. magnesia.

(*Q*) How can a farmer buy Thomas phosphate?

(*A*) Any farmer can buy it of the importers or of any fertilizer dealer who deals in fertilizers.

MATERIALS.

Lesson 11.

(*Q*) What is potassium?

(*A*) Potassium is a bluish-white, lustrous metal, having a strong affinity for oxygen. It is the basis of potash.

(*Q*) What is potash?

(*A*) Potash is an oxide of potassium. It is a powerful alkali.

(*Q*) What is kainit?

(*A*) Kainit is a potash salt containing 12 per cent. potash. It contains chlorine and is used as a fertilizer.

(*Q*) What is manure salts?

(*A*) Manure salts is a form of potash containing 20 per cent. potash. It contains chlorine and is used as a fertilizer.

(*Q*) What is muriate of potash?

(*A*) Muriate of potash is a potash salt containing 50 per cent. potash. It contains chlorine and is used as a fertilizer.

(*Q*) What is sulphate of potash?

(*A*) Sulphate of potash is a potash salt containing 50 per cent. potash. It contains no chlorine and is used as a fertilizer.

(*Q*) What is nitrate of potash?

(*A*) Nitrate of potash is a potash salt containing 15 per cent. ammonia and 44 per cent. potash. It contains no chlorine and is a rich and valuable fertilizer.

MATERIALS.

Lesson 12.

(*Q*) Where do we get all these potashes?

(*A*) These potashes are minerals. They are dug from the mines in Germany and imported to this country.

(*Q*) What is meant by chlorine in some forms of potashes?

(*A*) The chlorine in some forms of potashes means the acid of salt.

(*Q*) Can you name some plants that demand potash in a form free from chlorine?

(*A*) Some plants demand potash in a form free from chlorine for their best development. They are as follows: Tobacco, beets, onions, turnips, sweet potatoes, irish potatoes, cane and cantaloupes.

(*Q*) How can the farmer buy all these potashes?

(*A*) The farmer can buy all these potashes of the importers or of any fertilizer dealer who deals in fertilizers.

(*Q*) Which of these forms of potashes are mostly used by manufacturers of commercial fertilizers?

(*A*) Kainit is the form mostly used, as it furnishes weight for a filler.

MATERIALS.

Lesson 13.

(*Q*) What is a pound of phosphoric acid worth?

(*A*) A pound of phosphoric acid in raw material is worth four cents. A pound in mixed fertilizers is worth four and one-half cents.

(*Q*) What is a pound of nitrogen worth?

(*A*) A pound of nitrogen in raw material is worth nineteen and one-half cents. A pound in mixed fertilizers is worth twenty-one cents.

(*Q*) What is a pound of potash worth?

(*A*) A pound of potash in raw material is worth four cents. A pound in mixed fertilizers is worth five cents.

(*Q*) What is a ton of kainit, 12 per cent. potash, worth?

(*A*) A ton of kainit, 12 per cent. potash, is worth $9.60 at the port.

(*Q*) What is a ton of manure salts, 16 per cent. potash, worth?

(*A*) A ton of manure salts, 16 per cent. potash, is worth $12.80 at the port.

(*Q*) What is a ton of muriate of potash, 50 per cent. potash, worth?

(*A*) A ton of muriate of potash, 50 per cent. potash, is worth $40.00 at the port.

(*Q*) What is a ton of sulphate of potash worth?

(*A*) A ton of sulphate of potash, 50 per cent. potash, is worth $45.00 at the port.

(*Q*) What is a ton of nitrate of potash worth?

(*A*) A ton of nitrate of potash, 15 per cent. ammonia and 44 per cent. potash, is worth $85.00 at the port.

MATERIALS.

Lesson 14.

(*Q*) What is a ton of cotton seed meal worth?

(*A*) A ton of cotton seed meal containing 2½ per cent. phosphoric acid, 7½ per cent. ammonia and 1½ per cent. potash, is worth $30.00 at the oil mills.

(*Q*) What is a ton of fish guano, containing 6½ per cent. phosphoric acid and 10 per cent. ammonia, worth?

(*A*) A ton of fish guano, containing 6½ per cent. phosphoric acid and 10 per cent. ammonia, is worth $35.00 at the port.

(*Q*) What is a ton of tankage, containing 8 per cent. phosphoric acid and 10 per cent. ammonia, worth?

(*A*) A ton of tankage, containing 8 per cent. phosphoric acid and 10 per cent. ammonia, is worth $38.00 at the port.

(*Q*) What is a ton of dried blood worth?

(*A*) A ton of dried blood, containing 16 per cent. ammonia, is worth $59.00 at the port.

(*Q*) What is a ton of nitrate of soda worth?

(*A*) A ton of nitrate of soda, containing 18 per cent. ammonia, is worth $50.00 at the port.

(*Q*) What is a ton of acid phosphate worth?

(*A*) A ton of acid phosphate, 16 per cent. phosphoric acid, is worth $12.80 at the port.

(*Q*) What is a ton of Thomas phosphate worth?

(*A*) A ton of Thomas phosphate, 18 per cent. phosphoric acid, is worth $13.50 at the port.

(*Q*) What is a ton of lime worth?

(*A*) A ton of lime, containing 92 per cent. lime carbonate, is worth $3.00 at the lime kilns.

(*Q*) What is a ton of gypsum worth?

(*A*) A ton of gypsum is worth $7.00 at the port.

MATERIALS.

Lesson 15.

(*Q*) What is a ton of sulphate of ammonia worth?

(*A*) A ton of sulphate of ammonia, containing 20 per cent. nitrogen, is worth $80.00 at the port.

(*Q*) What is a ton of bone meal worth?

(*A*) A ton of bone meal, containing 4 per cent. nitrogen and 18 per cent. phosphoric acid, is worth $28.00 at the port.

(*Q*) What is a ton of stable manure worth?

(*A*) A ton of stable manure is worth $2.50.

(*Q*) What is a ton of nodules grown on cow peas or crimson clover worth?

(*A*) A ton of nodules grown on cow peas or crimson clover is worth $32.00.

(*Q*) Do the prices of fertilizer materials fluctuate?

(*A*) The prices of fertilizer materials fluctuate like all other articles of commerce.

(*Q*) How many pounds of nitrogen are required to make 500 pounds of lint cotton?

(*A*) Five hundred pounds of lint cotton will remove from an acre of land 65 pounds of nitrogen.

(*Q*) How many pounds of potash are required to make 500 pounds of lint cotton?

(*A*) Five hundred pounds of lint cotton will remove from an acre of land 77 pounds of potash.

(*Q*) How many pounds of phosphoric acid are required to make 500 pounds of lint cotton?

(*A*) Five hundred pounds of lint cotton will remove 32 pounds of phosphoric acid from an acre of land.

(*Q*) How many pounds of lime are required to make 500 pounds of lint cotton?

(*A*) Five hundred pounds of lint cotton will remove from an acre of land 60 pounds of lime.

MATERIALS.

Lesson 16.

(*Q*) How many pounds of nitrogen are required to make 50 bushels of shelled corn?

(*A*) Fifty bushels of shelled corn will remove from the soil 80 pounds of nitrogen.

(*Q*) How many pounds of potash are required to make 50 bushels of shelled corn?

(*A*) Fifty bushels of shelled corn will remove from the soil 55 pounds of potash.

(*Q*) How many pounds of phosphoric acid are required to make 50 bushels of shelled corn?

(*A*) Fifty bushels of shelled corn will remove from the soil 30 pounds of phosphoric acid.

(*Q*) How many pounds of lime are required to make 50 bushels of shelled corn?

(*A*) Fifty bushels of shelled corn will remove from the soil 78 pounds of lime.

(*Q*) How many pounds of nitrogen are required to make 1,500 pounds of cured tobacco?

(*A*) One thousand five hundred pounds of dried tobacco will remove from the soil 90 pounds of nitrogen.

(*Q*) How many pounds of potash are required to make 1,500 pounds of dried tobacco?

(*A*) One thousand five hundred pounds of dried tobacco will remove 115 pounds of potash.

(*Q*) How many pounds of phosphoric acid are required to make 1,500 pounds of dried tobacco?

(*A*) One thousand five hundred pounds of dried tobacco will remove from the soil 16 pounds of phosphoric acid.

(*Q*) How many pounds of lime are required to make 1,500 pounds of dried tobacco?

(*A*) One thousand five hundred pounds of dried tobacco will remove from the soil 120 pounds of lime.

CALCIUM.

Lesson 17.

(*Q*) What is calcium?

(*A*) Calcium is the metallic basis of lime.

(*Q*) What is lime?

(*A*) Lime is the oxide of calcium.

(*Q*) What is calcium oxide?

(*A*) Calcium oxide is the lime-stone rock burnt. It is builders' lime.

(*Q*) What is calcium hydroxide?

(*A*) Calycium hydroxide is air-slaked lime or pulverized lime.

(*Q*) What is caustic lime?

(*A*) Caustic lime is lime not carbonated.

(*Q*) What is calcium carbonate?

(*A*) Calcium carbonate is lime carbonated by carbonic acid.

(*Q*) What is calcium phosphate?

(*A*) Calcium phosphate is the phosphate rock which contains phosphorous.

(*Q*) What is calcium surphate?

(*A*) Calcium sulphate is gypsum.

(*Q*) When gypsum is calcined, what does it form?

(*A*) Gypsum calcined forms plaster of paris.

CALCIUM.

Lesson 18.

(*Q*) Which is the better form of lime for agricultural purposes, caustic or carbonate?

(*A*) Caustic lime applied to soils containing rough vegetable matter hastens the decay of such matter and destroys humus. Caustic lime is not a plant food. Lime carbonate is a plant food and the most desirable form for all agricultural purposes.

(*Q*) How does lime affect sandy soils?

(*A*) Lime applied to sandy soils makes them stiff soils. If applied to such soils is of little value if they contain no decayed vegetable or mineral matter.

(*Q*) How does lime affect clay or stiff soils?

(*A*) Lime applied to clay or stiff soils makes them mellow and liberates the potash in them.

(*Q*) What forms of acid soils will lime counteract?

(*A*) Lime will counteract all forms of acid soils, such as ulmic, humic and crenic.

(*Q*) What causes ulmic, humic and crenic forms of acid soils?

(*A*) Ulmic, humic and crenic forms of acid soils are caused by decayed vegetable matter in the soil and the use of fertilizers that contain an acid not neutralized. Improper drainage and tillage produce sour soils.

CALCIUM.

Lesson 19.

(*Q*) What kind of soil bacteria are destroyed by the use of lime?

(*A*) Harmful bacteria are destroyed by the use of lime.

(*Q*) How can the farmer tell whether or not his soils contain acid or are sour?

(*A*) The farmer can tell whether or not his soils contain acid by using an acid tester. The acid tester determines whether or not his soils contain acid and it also registers the number of pounds of lime required per acre to take out the acid.

(*Q*) When should lime be applied?

(*A*) Best to apply it in the fall, if possible. Always broadcast lime and harrow it in.

(*Q*) When is the best time to apply lime for green crops plowed under?

(*A*) Plow under the green crops, then disk thoroughly, broadcasting the lime before disking.

(*Q*) Can corn or cotton grow on sour soils that would require 2,000 pounds of lime per acre to counteract the acid?

(*A*) Yes, corn and cotton will grow on such soils, but would make far better crops, if the soil was sweet, on less fertilizer.

(*Q*) Why will any crop produce more on a sweet soil than a sour soil?

(*A*) All sweet soils, well drained and well tilled, containing an abundance of humus, are well supplied with nitrate-forming bacteria. Such soils always produce good crops. Nitrate-forming bacteria can not thrive successfully in a sour soil.

ACIDS.

Lesson 29.

(*Q*) What is phosphoric acid?

(*A*) Phosphoric acid is a plant food obtained from the phosphorous of various substances or materials by some chemical combination.

(*Q*) Can you name some fertilizer materials that contain phosphorous?

(*A*) Cotton seed meal, fish guano, tankage, bone meal, calcium phosphate and castor pomace contain phosphorous.

(*Q*) How is the phosphorous in cotton seed meal, fish guano, tankage, castor pomace, calcium phosphate and all vegetable matter naturally converted into phosphoric acid?

(*A*) The phosphorous in all these materials or elements is naturally converted into phosphoric acid by the chemical action of nitrification through nitric acid, which is obtained from some source of ammonia or nitrogen.

(*Q*) How does the phosphorous in the phosphate rock become available artificially?

(*A*) It becomes available artificially by the treatment of sulphuric acid.

(*Q*) What is sulphuric acid?

(*A*) Sulphuric acid is a compound of sulphur, oxygen and hydrogen.

(*Q*) What is nitric acid?

(*A*) Nitric acid is a compound of nitrogen and oxygen. It is the final product which is obtained by chemically releasing ammonia or nitrogen.

ACIDS.

Lesson 21.

(*Q*) How is nitric acid naturally obtained?

(*A*) Nitric acid is naturally found in compost heaps and in all soils where animal and vegetable matter are undergoing decay in contact with the air.

(*Q*) What happens when nitric acid comes in contact with soda, lime, potash, magnesia, etc.?

(*A*) When nitric acid comes in contact with potash it forms nitrate of potash. When it comes in contact with lime it forms nitrate of lime, etc.

(*Q*) What is ulmic acid?

(*A*) Ulmic acid is a compound of carbon, hydrogen and oxygen. It combines with lime, magnesia, alumina and oxide of iron. It is produced by the decay of vegetable matter in the soil. It requires 2,500 times its weight of water to dissolve it.

(*Q*) What is humic acid?

(*A*) Humic acid is a compound of carbon, hydrogen and oxygen. It is produced by the sour forms of humus which is obtained from decayed matter in the soil. It combines with lime, magnesia and oxide of iron.

(*Q*) What is crenic acid?

(*A*) Crenic acid is a form of acid formed in the soil during the decay of green vegetable matter. It is distinguished from ulmic and humic forms of acid by containing nitrogen as an essential element. It forms a compound with lime and is soluble in water.

(*Q*) What is carbonic acid?

(*A*) Carbonic acid is a compound of carbon and oxygen.

BACTERIA.

Lesson 22.

(*Q*) What are soil bacteria?

(*A*) Soil bacteria are microscopic germs, organisms, plants or bacteria that live in different conditions of soil.

(*Q*) How many kinds of soil bacteria are there that affect the farmer in the production of plants?

(*A*) There are three kinds of soil bacteria that affect the farmer in the production of plants. They are as follows: (1) harmful bacteria, (2) nitrate-forming bacteria, (3) legume bacteria.

(*Q*) What are harmful bacteria?

(*A*) Harmful bacteria are bacteria that hold sway in acid or sour soils. They destroy legume and nitrate-forming bacteria.

(*Q*) Why are they called harmful bacteria?

(*A*) They are called harmful bacteria because they do us harm. They are our greatest soil enemies.

(*Q*) How are harmful bacteria destroyed?

(*A*) When lime is applied to acid or sour soils the acid combines with the lime and when this combination takes place the harmful bacteria perish.

(*Q*) What are nitrate-forming bacteria?

(*A*) Nitrate-forming bacteria are bacteria that produce nitric acid by the process of nitrification in the soil.

BACTERIA.

Lesson 23.

(*Q*) What elements or properties carry nitrate-forming bacteria?

(*A*) All properties or materials containing ammonia or nitrogen carry nitrate-forming bacteria. All decaying animal and vegetable matter contain nitrate-forming bacteria.

(*Q*) Of what value are nitrate-forming bacteria to the farmer?

(*A*) Nitrate-forming bacteria make nitric acid and nitric acid has the controlling power in the soil to make the distribution of all other properties for the use of plants.

(*Q*) In what kind of soils can nitrate-forming bacteria live?

(*A*) Nitrate-forming bacteria cannot thrive successfully in an acid or sour soil. Good drainage and tillage encourage the growth of nitrate-forming bacteria.

(*Q*) How can the farmer keep a good supply of nitrate-forming bacteria in his soil?

(*A*) Every farmer can keep a good supply of nitrate-forming bacteria by keeping a full supply of humus in the soil. Grow and turn under legume crops for cheap humus.

(*Q*) What are legume bacteria?

(*A*) Legume bacteria are very small plants that bore into the roots of legume plants.

(*Q*) How do legume bacteria live?

(*A*) They live on carbohydrates and nitrogen gas.

BACTERIA.

Lesson 24.

(*Q*) How do legume bacteria make nitrogen?

(*A*) They digest the food they eat and it is deposited in the nodules on the roots of the plants in the form of a nitrate.

(*Q*) What is the form of the nitrate in these nodules?

(*A*) The nitrogen in these nodules is in the form of albumoid.

(*Q*) What per cent. of these nodules is nitrogen?

(*A*) These nodules are 8 per cent. nitrogen.

(*Q*) When does the nitrogen in these nodules become available?

(*A*) The nitrogen in these nodules becomes available when the nodules decay.

(*Q*) How are legume bacteria cultured?

(*A*) Legume bacteria are cultured by selecting choice forms of the bacteria and breeding the culture.

(*Q*) Does each legume plant carry its own kind of bacteria?

(*A*) Each legume plant carries its own kind of bacteria.

(*Q*) Can legume bacteria live in acid soils?

(*A*) Legume bacteria cannot thrive successfully in acid or sour soils. For this reason we lime soils for legume crops.

(*Q*) Where are cultures of bacteria produced?

(*A*) These cultures are bred in the laboratory.

(*Q*) How does the farmer inoculate his seeds of legume plants with cultured bacteria?

(*A*) All farmers who wish success for inoculation of the seeds of legume plants, can use Farmogerm.

HOME MIXING FERTILIZERS.

Lesson 25.

(*Q*) What is home-mixing fertilizers?

(*A*) Home-mixing fertilizers is buying materials and compounding them in the proper proportion for the need of plants.

(*Q*) How can you tell the number of pounds of acid phosphate or Thomas phosphate that are required to make a ton of fertilizer that will analyze 8 per cent. phosphoric acid?

(*A*) Multiply the number of hundred weight in a ton by the per cent. required, annex two ciphers and divide by the per cent. of the material used. Thus: $20 \times 8 = 160.00 \div 16 =$ 1,000 pounds.

(*Q*) How can you tell the number of pounds of nitrate of soda and cotton seed meal that are required to make a ton of fertilizer analyzing 4 per cent. ammonia?

(*A*) Multiply the number of hundred weight in a ton by the per cent. required, annex two ciphers and divide by the per cent. of the material used if you are using only one material. Two hundred pounds of nitrate of soda furnish 36 pounds of ammonia. Eighty pounds of ammonia are required to make the ton analyzing 4 per cent. Eighty pounds minus 36 pounds equal 44 pounds more, which we get from cotton seed meal, annex two ciphers to the 44 and divide by 8 the per cent. of the cotton seed meal, and we have 550 pounds of cotton seed meal and 200 pounds of nitrate of soda which, when combined, make the ton analyzing 4 per cent. ammonia.

HOME MIXING FERTILIZERS.

Lesson 26.

(*Q*) How can you tell the number of pounds of muriate of potash that are required to make a ton of fertilizer analyzing 10 per cent. potash?

(*A*) Multiply the number of hundred weight in a ton by the per cent. required, annex two ciphers and divide by the per cent. of the material used.

Thus: $20 \times 10 = 200.00 \div 50 = 400$ pounds.

(*Q*) How can you tell the number of pounds of kainit that are required to make a ton of fertilizer analyzing 2 per cent. potash?

(*A*) Multiply the number of hundred weight in a ton by the per cent. required, annex two ciphers and divide by the per cent. of the material used.

Thus: $20 \times 2 = 40.00 \div 12 = 333$ 1-3 pounds.

(*Q*) How many pounds of dried blood are required to make a ton of fertilizer analyzing 4 per cent. ammonia?

(*A*) Multiply the number of hundred weight in a ton by the per cent. required, annex two ciphers and divide by the per cent. of the material used.

Thus: $20 \times 4 = 80.00 \div 16 = 500$ pounds.

(*Q*) Should the ammonia in a ton of fertilizer always be secured from one material in making a ton of fertilizer?

(*A*) The best results are always obtained when we get ammonia from more than one material. Nitrate of soda, tankage, fish guano, dried blood and cotton seed meal are safe sources for ammonia.

HOME MIXING FERTILIZERS.

Lesson 27.

(*Q*) What are the necessary tools or implements to use in home mixing?

(*A*) Use a box 16 x 8 feet, 10 inches deep. Pour your materials into the box in layers. If you use nitrate of soda, take it first and carefully crush all lumps in bottom of box. Then pour in separately, in layers, the other materials and use hoe, carrying back and fourth twice. Then use shovel and place back into same bags.

(*Q*) Will it be necessary to use dirt or any material as a filler to make the number of pounds in the ton weight exactly 2,000 pounds?

(*A*) You need no dirt or filler of any kind. The materials you use contain all the filler you need. There is no business in buying a fertilizer containing a filler such as worthless dirt.

(*Q*) How much can a farmer save by doing his own mixing?

(*A*) Any farmer can save from $3.00 to $6.00 on each ton he mixes.

(*Q*) Is there any other advantage in home mixing?

(*A*) The farmer who does his own mixing dictates for himself and mixes the materials to suit the demand of his plants.

TONNAGE FORMULAS.

Lesson 28.

CORN FORMULA.

Materials	Lbs.	Phos. Acid	Ammo.	Potash	Cost
Thomas Phosphate	800	144	----	----	$ 6.80
Nitrate of Soda	100	----	18	----	2.40
Fish Guano	600	36	60	----	11.40
Muriate of Potash	200	----	----	100	4.00
	1700	20) 180	78	100	$24.60
		9%	3.9%	5%	

Application of this mixture: Use 200 to 400 pounds per acre in drill before planting. When corn is 12 to 20 inches high use 400 pounds per acre as a side dresser. When corn bunches for tassel use 100 to 150 pounds of Nitrate of Soda per acre broadcasted along the center of row and harrow in.

CORN FORMULA.

Materials	Lbs.	Phos. Acid	Ammo.	Potash	Cost
Thomas Phosphate	1000	180	----	----	$ 8.50
Nitrate of Soda	100	----	18	----	2.40
Cotton Seed Meal	700	17	52	10	9.10
Muriate of Potash	200	----	----	100	4.00
	2000	20) 197	70	110	$24.00
		9%	3.5%	5%	

Application of this mixture: Use 200 to 400 pounds of this mixture per acre in drill before planting. When corn is 12 to 20 inches high use 400 pounds per acre as a side dresser. When corn begins to bunch for tassel, use 100 to 150 pounds of Nitrate of Soda per acre as a side dresser.

CORN FORMULA.

Materials	Lbs.	Phos. Acid	Ammo.	Potash	Cost
Thomas Phosphate	800	144	----	----	$ 6.80
Nitrate of Soda	200	----	36	----	4.80
Tankage	600	36	60	----	13.20
Muriate of Potash	400	----	----	200	8.00
	2000	20) 180	96	200	$32.80
		9%	4.8%	10%	

Application of this mixture: Use 200 to 400 pounds per acre in drill before planting. When corn is 12 or 20 inches high use 400 to 600 pounds per acre as a side dresser. When corn bunches for tassel use 200 pounds Nitrate of Soda in center of middle and harrow in.

Lesson 29.

COTTON FORMULA.

Materials	Lbs.	Phos. Acid	Ammo.	Potash	Cost
Thomas Phosphate	1000	180	----	----	$ 8.50
Nitrate of Soda	200	----	36	----	4.80
Fish Guano	600	20	60	----	11.40
Muriate of Potash	200	----	----	100	4.00
	2000	20) 200	96	100	$28.70
		10%	4.8%	5%	

Application of this mixture: Use 600 pounds per acre in drill before planting. When cotton is 6 to 8 inches high use 400 pounds per acre as a side dresser. When cotton begins to bloom use 100 pounds of Nitrate of Soda per acre as a side dresser.

COTTON FORMULA.

Materials	Lbs.	Phos. Acid	Ammo.	Potash	Cost
Thomas Phosphate	400	72	----	----	$ 3.40
Tankage	1200	78	120	----	26.40
Muriate of Potash	400	----	----	200	8.00
	2000	20) 150	120	200	$37.80
		7%	6%	10%	

Application of this mixture: Use 400 pounds per acre in drill before planting. When cotton is 6 or 8 inches high use 400 pounds per acre as a side dresser. When cotton begins to bloom use 100 pounds of Nitrate of Soda per acre as a side dresser.

COTTON FORMULA.

Materials	Lbs.	Phos. Acid	Ammo.	Potash	Cost
Tankage	1600	104	160	....	$35.20
Muriate of Potash	400	....	....	200	8.00
	2000	20) 104	160	200	$43.20
		5%	8%	10%	

Application of this mixture: Use 300 pounds per acre in drill before planting. When cotton is 6 or 8 inches high use 200 pounds per acre as a side dresser. When cotton begins to bloom use 100 pounds of Nitrate of Soda as a side dresser per acre.

Lesson 30.

COTTON FORMULA.

Materials	Lbs.	Phos. Acid	Ammo.	Potash	Cost
Thomas Phosphate	1000	180	....	....	$ 8.50
Nitrate of Soda	200	....	36	....	4.80
Cotton Seed Meal	600	15	45	9	9.00
Muriate of Potash	200	....	....	100	4.00
	2000	20) 195	81	109	$26.30
		9%	4%	5%	

Application of this mixture: Use 600 pounds per acre in drill before planting. When cotton is 6 or 8 inches high use 400 pounds as a side dressed. When cotton begins to bloom use 100 pounds of Nitrate of Soda per acre as a side dresser.

COTTON FORMULA.

Materials	Lbs.	Phos. Acid	Ammo.	Potash	Cost
Thomas Phosphate	1000	180	....	....	$ 8.50
Nitrate of Soda	200	....	36	....	4.80
Dried Blood	275	....	44	....	8.95
Muriate of Potash	200	....	....	100	4.00
	1675	20) 180	80	100	$26.25
		9%	4%	5%	

Application of this mixture: Use 600 pounds of this mixture per acre in drill before planting. When cotton is 6 or 8 inches high use 225 pounds per acre as a side dresser. When cotton begins to bloom use 100 pounds of Nitrate of Soda as a side dresser.

COTTON FORMULA.

Materials	Lbs.	Phos. Acid	Ammo.	Potash	Cost
Thomas Phosphate	1000	180	----	----	$ 8.50
Nitrate of Soda	200	----	36	----	4.80
Tankage	600	20	54	----	13.20
Muriate of Potash	200	----	----	100	4.00
	2000	20) 200	90	100	$30.50
		10%	4.5%	5%	

Application of this mixture: Use 600 pounds per acre in drill before planting. When cotton is 6 or 8 inches high use 400 pounds as a side dresser per acre. When cotton begins to bloom use 100 pounds of Nitrate of Soda per acre as a side dresser.

Lesson 31.

TOBACCO FORMULA.

Materials	Lbs.	Phos. Acid	Ammo.	Potash	Cost
Thomas Phosphate	800	144	----	----	$ 6.80
Nitrate of Soda	100	----	18	----	2.40
Dried Blood	140	----	22	----	4.55
Sulfate of Potash	200	----	----	100	4.80
	1240	20) 144	82	200	$18.55
		7%	2%	5%	

Application of this mixture: Use from 400 to 800 pounds per acre in drill before transplanting.

TOBACCO FORMULA.

Materials	Lbs.	Phos. Acid	Ammo.	Potash	Cost
Thomas Phosphate	800	144	----	----	$ 6.80
Nitrate of Soda	100	----	18	----	2.40
Dried Blood	400	----	64	----	13.00
Sulfate of Potash	400	----	----	200	9.60
	1700	10) 144	82	200	$31.80
		7%	4%	10%	

Application of this mixture: Use from 400 to 600 pounds of this mixture per acre in drill before transplanting.

TOBACCO FORMULA.

Materials	Lbs.	Phos. Acid	Ammo.	Potash	Cost
Thomas Phosphate	1000	180	----	----	$ 8.50
Nitrate of Soda	200	----	36	----	4.80
Dried Blood	400	----	64	----	13.00
Sulfate of Potash	400	----	----	200	9.60
	2000	20) 180	100	200	$35.90
		9%	5%	10%	

Application of this mixture: Use from 600 to 1000 pounds per acre in drill before transplanting.

Lesson 32.

PEANUT FORMULA.

Materials	Lbs.	Phos. Acid	Ammo.	Potash	Cost
Thomas Phosphate	1000	180	----	----	$ 8.50
Nitrate of Soda	100	----	18	----	2.40
Fish Guano	400	20	42	----	7.60
Muriate of Potash	200	----	----	100	4.00
	1700	20) 200	60	100	$22.50
		9%	3%	5%	

Application of this mixture: Use from 400 to 600 pounds of this mixture per acre in drill before planting.

PEANUT FORMULA.

Materials	Lbs.	Phos. Acid	Ammo.	Potash	Cost
Thomas Phosphate	1000	180	----	----	$ 8.50
Nitrate of Soda	100	----	18	----	2.40
Cottonseed Meal	600	15	45	9	9.00
Muriate of Potash	200	----	----	100	4.00
	1900	20) 195	63	109	$23.90
		9%	3%	5%	

Application of this mixture: Use from 400 to 600 pounds of this mixture per acre in drill before planting.

COWPEA FORMULA.

Materials	Lbs.	Phos. Acid	Ammo.	Potash	Cost
Thomas Phosphate	1000	180	----	----	$ 8.50
Nitrate of Soda	100	----	18	----	2.40
Tankage	700	20	62	----	15.40
Muriate of Potash	200	----	----	100	4.00
	2000	20) 200	80	100	$30.30
		10%	4%	5%	

Application of this mixture: Use from 400 to 600 pounds of this mixture per acre in drill before planting. Use 800 pounds per acre if you broadcast.

Lesson 33.

CABBAGE FORMULA.

Materials	Lbs.	Phos. Acid	Ammo.	Potash	Cost
Thomas Phosphate	800	144	----	----	$ 6.80
Nitrate of Soda	400	----	72	----	9.60
Dried Blood	400	----	68	----	13.00
Muriate of Potash	400	----	----	200	8.00
	2000	20) 144	140	200	$37.40
		7%	7%	10%	

Application of this mixture: Use 1000 pounds of this mixture per acre in drill, broadcasting stable manure in drill first and thoroughly mixing with soil.

ASPARAGUS FORMULA.

Materials	Lbs.	Phos. Acid	Ammo.	Potash	Cost
Thomas Phosphate	400	72	----	----	$ 3.40
Nitrate of Soda	400	----	72	----	9.60
Dried Blood	600	----	96	----	19.50
Muriate of Potash	400	----	----	200	8.00
	1800	20) 72	168	200	$40.50
		3.6%	8.4%	10%	

Application of this mixture: Use from 600 to 900 pounds of this mixture per acre in fall and same amount in early spring.

DEWBERRY FORMULA.

Materials	Lbs.	Phos. Acid	Ammo.	Potash	Cost
Thomas Phosphate	800	144	----	----	$ 6.80
Nitrate of Soda	200	----	36	----	4.80
Cottonseed Meal	600	16	45	9	9.00
Muriate of Potash	400	----	----	200	8.00
	2000	20) 160	81	209	$28.60
		8%	4%	10%	

Application of this mixture: Use 1000 pounds of this mixture per acre in fall and same amount in early spring.

Lesson 34.

IRISH POTATO FORMULA.

Materials	Lbs.	Phos. Acid	Ammo.	Potash	Cost
Thomas Phosphate	800	144	----	----	$ 6.80
Nitrate of Soda	200	----	36	----	4.80
Cottonseed Meal	600	16	44	9	9.00
Sulfate of Potash	400	----	----	200	9.60
	2000	20) 160	80	209	$30.20
		8%	4%	10%	

Application of this mixture: Use 1000 pounds of this mixture per acre in drill well mixed with soil. Broadcast liberally in the drill stable manure before applying the fertilizer.

STRAWBERRY FORMULA.

Materials	Lbs.	Phos. Acid	Ammo.	Potash	Cost
Thomas Phosphate	1000	180	----	----	$ 8.50
Nitrate of Soda	200	----	36	----	4.80
Fish Guano	600	20	60	----	11.40
Muriate of Potash	200	----	----	100	4.00
	2000	20) 200	96	100	$28.70
		10%	4.8%	5%	

Application of this mixture: Use 1000 pounds of this mixture per acre in fall and 1000 pounds in early spring.

SWEET POTATO FORMULA.

Materials	Lbs.	Phos. Acid	Ammo.	Potash	Cost
Thomas Phosphate	800	144	----	----	$ 6.80
Nitrate of Soda	200	----	36	----	4.80
Cottonseed Meal	600	16	44	9	9.00
Sulfate of Potash	400	----	----	200	9.60
	2000	20) 160	80	209	$30.20
		8%	4%	10%	

Application of this mixture: Use 400 to 600 pounds of this mixture per acre in drill. Lightly broadcast stable manure in drill before applying the fertilizer. Just before hilling bar off each row lightly and broadcast Nitrate of Soda in the barred furrow at the rate of 100 pounds per acre.

Lesson 35.

CORN FORMULA.

Materials	Lbs.	Phos. Acid	Ammo.	Potash	Cost
Thomas Phosphate	800	144	----	----	$ 6.80
Cottonseed Meal	800	20	60	12	10.40
Kainit	400	----	----	48	2.40
	2000	20) 164	60	60	$19.60
		8%	3%	3%	

Application of this mixture: Use 200 to 400 pounds per acre in drill before planting. When corn is 12 to 20 inches high use 400 pounds per acre as a side dresser. When corn bunches for tassel use 200 pounds Nitrate of Soda as a side dresser, per acre.

TOP DRESSER FORMULA.

Materials	Lbs.	Phos. Acid	Ammo.	Potash	Cost
Nitrate of Soda	1200	----	216	----	$28.80
Tankage	600	40	60	----	13.20
Muriate of Potash	200	----	----	100	4.00
	2000	20) 40	276	100	$46.00
		2%	13.8%	5%	

Application of this mixture: Use 200 to 400 pounds of this mixture per acre as a side dresser for any crop.

TOP DRESSER FORMULA.

Materials	Lbs.	Phos. Acid	Ammo.	Potash	Cost
Nitrate of Soda	1000	----	180	----	$24.00
Cottonseed Meal	800	20	60	12	12.00
Muriate of Potash	200	----	----	100	4.00
	2000	20) 20	240	112	$40.00
		1%	12%	5.6%	

Application of this mixture: Use 200 to 400 pounds of this mixture per acre as a side dresser for any crop.

Lesson 36.

OAT FORMULA.

Materials	Lbs.	Phos. Acid	Ammo.	Potash	Cost
Thomas Phosphate	1000	180	----	----	$ 8.50
Cottonseed Meal	600	15	45	9	9.00
Muriate of Potash	400	----	----	200	8.00
	2000	20) 195	45	249	$25.50
		9%	2%	10%	

Application of this mixture: Use from 400 to 600 pounds of this mixture per acre at the time of seeding. When danger of frost is past use 100 pounds of Nitrate of Soda per acre as a top dresser.

OAT FORMULA.

Materials	Lbs.	Phos. Acid	Ammo.	Potash	Cost
Thomas Phosphate	1400	252	----	----	$11.90
Muriate of Potash	600	----	----	300	12.00
	2000	20) 252	0	300	$23.90
		12%	0%	15%	

Application of this mixture: Use from 300 to 500 pounds of this mixture per acre. When danger of frost is past use 100 pounds of Nitrate of Soda as a top dresser.

WATERMELON FORMULA.

Materials	Lbs.	Phos. Acid	Ammo.	Potash	Cost
Thomas Phosphate	1000	180	----	----	$ 8.50
Nitrate of Soda	200	----	36	----	4.80
Cottonseed Meal	600	15	44	9	9.00
Muriate of Potash	200	----	----	100	4.00
	2000	20) 195	80	109	$26.30
		9%	4%	5%	

Application of this mixture: Use from 600 to 1000 pounds per acre in drill. Have rows ten feet apart. Hills in rows from 4 to 6 feet. Broadcast stable manure lightly in drill before applying fertilizer. When vines begin to run, say 12 or 14 inches, use 50 pounds of Nitrate of Soda per acre around the hills.

Lesson 37.

COWPEA FORMULA.

Materials	Lbs.	Phos. Acid	Ammo.	Potash	Cost
Thomas Phosphate	1000	180	----	----	$ 8.50
Nitrate of Soda	100	----	18	----	2.40
Fish Guano	400	20	42	----	7.60
Muriate of Potash	500	----	----	250	10.00
	2000	20) 200	60	250	$28.50
		10%	3%	12%	

Application of this mixture: Use from 400 to 600 pounds of this mixture per acre in drill. Use 600 pounds per acre if you broadcast.

COWPEA FORMULA.

Materials	Lbs.	Phos. Acid	Ammo.	Potash	Cost
Thomas Phosphate	1000	180	----	----	$ 8.50
Nitrate of Soda	225	----	40	----	5.40
Muriate of Potash	200	----	----	100	4.00
	1425	20) 180	40	100	$17.90
		9%	2%	5%	

Application of this mixture: Use from 400 to 600 pounds of this mixture per acre in drill.

COWPEA FORMULA.

Materials	Lbs.	Phos. Acid	Ammo.	Potash	Cost
Thomas Phosphate	1000	180	----	----	$ 8.50
Muriate of Potash	400	----	----	200	8.00
	1400	20) 180	0	200	$16.50
		9%	0%	10%	

Application of this mixture: Use from 400 to 600 pounds of this mixture per acre in drill. 600 pounds per acre if broadcast.

This formula is for land that produces all vines and no peas. The cow pea is a legume plant and like clovers connot thrive well in acid or sour soils. Test your soils for acidity and you can tell whether or not Thomas Phosphate will furnish all the lime you need. Take the acid out of your soil, fertilize it, inoculate your seed peas with Farmogerm and you will make peas and a crop of nodules.

Lesson 38.

RYE FORMULA.

Materials	Lbs.	Phos. Acid	Ammo.	Potash	Cost
Thomas Phosphate	800	144	----	----	$ 6.80
Bone Meal	800	64	56	----	11.20
Muriate of Potash	400	----	----	200	8.00
	2000	20) 208	56	200	$26.00
		10%	2.8%	10%	

Application of this mixture: Use from 200 to 400 pounds of this mixture per acre. When danger of frost is past, use 100 pounds of Nitrate of Soda as a top dresser.

WHEAT FORMULA.

Materials	Lbs.	Phos. Acid	Ammo.	Potash	Cost
Thomas Phosphate	1000	180	----	----	$ 8.50
Fish Guano	600	36	60	----	11.10
Muriate of Potash	400	----	----	200	8.00
	2000	20) 216	60	200	$27.60
		10%	3%	10%	

Application of this mixture: Use from 400 to 600 pounds of this mixture per acre at time of seeding. When danger of frost is past use 100 pounds Nitrate of Soda as a top dresser.

WHEAT FORMULA.

Materials	Lbs.	Phos. Acid	Ammo.	Potash	Cost
Thomas Phosphate	800	144	----	----	$ 6.80
Bone Meal	800	64	56	----	11.20
Muriate Potash	400	----	----	200	8.00
	2000	20) 208	56	200	$26.00
		10%	2.8%	10%	

Application of this mixture: Use from 400 to 600 pounds of this mixture per acre at time of seeding. When danger of frost is past, use 100 pounds Nitrate of Soda as a top dresser.

Lesson 39.

WHEAT FORMULA.

Materials	Lbs.	Phos. Acid	Ammo.	Potash	Cost
Thomas Phosphate	1000	180	----	----	$ 8.50
Nitrate of Soda	100	----	18	----	2.50
Cottonseed Meal	600	15	45	10	9.00
Muriate of Potash	400	----	----	200	8.00
	2100	20) 195	63	210	$28.00
		9%	3%	10%	

Application for this mixture: Use broadcast 700 pounds of this mixture per acre before seeding.

RED CLOVER FORMULA.

Materials	Lbs.	Phos. Acid	Ammo.	Potash	Cost
Thomas Phosphate	1000	180	----	----	$ 8.50
Nitrate of Soda	100	----	18	----	2.50
Bone Meal	600	24	30	----	8.40
Muriate of Potash	400	----	----	200	8.00
	2100	20) 204	48	200	$27.40
		10%	2.4%	10%	

Application of this mixture: Use broadcast 700 pounds of this mixture per acre before seeding. Sow 25 pounds of seed per acre and inoculate seed with Farmogerm.

FORMULA FOR GRASSES.

Materials	Lbs.	Phos. Acid	Ammo.	Potash	Cost
Thomas Phosphate	1000	180	----	----	$ 8.50
Nitrate of Soda	200	----	36	----	5.00
Bone Meal	600	24	30	----	8.40
Muriate of Potash	200	----	----	100	4.00
	2000	20) 204	66	100	$25.90
		10%	3%	5%	

Application of this mixture: Use from 400 to 600 pounds of this mixture per acre, broadcast before seeding. Use from 30 to 40 pounds of mixed grass seed per acre. Never inoculate the seed of any plants except legume plants.

Lesson 40.

TOMATO FORMULA.

Materials	Lbs.	Phos. Acid	Ammo.	Potash	Cost
Acid Phosphate	800	128	----	----	$ 7.75
Nitrate of Soda	400	----	72	----	10.00
Muriate of Potash	600	----	----	300	12.00
Tankage	200	12	20	----	4.50
	2000	20) 140	92	300	$34.25
		7%	4.6%	15%	

Application of this mixture: Use 1000 pounds of this mixture per acre in drill well mixed with the soil before transplanting. When plants are 8 or 10 inches high use 400 pounds of a mixture, 200 of Nitrate of Soda and 200 of Tankage as a side dresser.

CANTELOUPE FORMULA.

Materials	Lbs.	Phos. Acid	Ammo.	Potash	Cost
Thomas Phosphate	1000	180	----	----	$ 8.50
Nitrate of Soda	200	----	36	----	5.00
Fish Guano	600	20	60	----	11.40
Sulfate of Potash	200	----	----	100	4.80
	2000	20) 200	96	100	$29.70
		10%	4.8%	5%	

Application of this mixture: Use in drill before planting, 1000 pounds per acre well mixed with the soil. When vines are 10 to 20 inches in length apply around the hills Nitrate of Soda at the rate of 100 pounds to the acre.

GARDEN PEA FORMULA.

Materials	Lbs.	Phos. Acid	Ammo.	Potash	Cost
Thomas Phosphate	800	144	----	----	$ 6.80
Nitrate of Soda	200	----	36	----	5.00
Sulfate of Potash	400	----	----	200	9.60
Cottonseed Meal	600	16	44	9	9.00
	2000	20) 160	80	209	$30.40
		8%	4%	10%	

Application of this mixture: Use 1000 pounds per acre in drill well mixed with the soil and inoculate seed with Farmogerm.

Lesson 41.

SMALL GRAIN FORMULA.

Materials	Lbs.	Phos. Acid	Ammo.	Potash	Cost
Acid Phosphate	1000	160	----	----	$ 7.00
Fish Guano	600	36	60	----	11.40
Muriate of Potash	400	----	----	200	8.00
	2000	20) 186	60	200	$26.40
		9%	3%	10%	

Application of this mixture: Use from 400 to 600 pounds of this mixture per acre at time of seeding. When all danger of frost is past, use 100 pounds Nitrate of Soda per acre as a top dresser.

SMALL GRAIN FORMULA.

Materials	Lbs.	Phos. Acid	Ammo.	Potash	Cost
Acid Phosphate	1000	160	----	----	$ 7.00
Cottonseed Meal	600	15	45	9	9.00
Muriate of Potash	400	----	----	200	8.00
	2000	20) 175	45	209	$24.00
		8%	2%	10%	

Application of this mixture: Use from 400 to 800 pounds of this mixture per acre at time of seeding. When all danger of frost is past, use 100 pounds Nitrate of Soda as top dresser.

SMALL GRAIN FORMULA.

Materials	Lbs.	Phos. Acid	Ammo.	Potash	Cost
Acid Phosphate	1600	256	----	----	$11.20
Muriate of Potash	400	----	----	200	8.00
	2000	20) 256	0	200	$19.20
		12%	0%	10%	

Application of this mixture: Use from 400 to 600 pounds of this mixture per acre at time of seeding. This formula suits better where the soil has been improved or where stable manure, cottonseed and rough manure can be broadcasted before seeding.

When danger of frost is past, use 100 pounds Nitrate of Soda as a top dresser.

Lesson 42.

TOBACCO FORMULA.

Materials	Lbs.	Phos. Acid	Ammo.	Potash	Cost
Acid Phosphate	1000	160	----	----	$ 7.00
Nitrate of Soda	200	----	36	----	4.80
Dried Blood	400	----	64	----	13.00
Sulfate of Potash	400	----	----	200	9.60
	2000	20) 160	100	200	$34.40
		8%	5%	10%	

Application of this mixture: Use from 400 to 1000 pounds of this mixture per acre in drill before transplanting.

IRISH POTATO FORMULA.

Materials	Lbs.	Phos. Acid	Ammo.	Potash	Cost
Acid Phosphate	1000	160	----	----	$ 7.00
Nitrate of Soda	325	----	58	----	7.80
Dried Blood	275	----	44	----	8.95
Sulfate of Potash	400	----	----	200	9.60
	2000	20) 160	102	200	$33.35
		8%	5%	10%	

Application of this mixture: Use from 1000 to 1200 pounds of this mixture per acre in drill well mixed with soil. If possible first drill in rows lightly some well rotted manure.

TRUCK AND GARDEN FORMULA.

Materials	Lbs.	Phos. Acid	Ammo.	Potash	Cost
Acid Phosphate	1000	160	----	----	$ 7.00
Nitrate of Soda	400	----	72	----	9.60
Dried Blood	200	----	34	----	6.50
Sulfate of Potash	400	----	----	200	9.60
	2000	20) 160	106	200	$32.70
		8%	5%	10%	

Application of this mixture: Use this mixture at the rate of 1000 to 1200 pounds per acre in drill well mixed with soil with some well rotted manure, or first broadcast the manure. Broadcast from 600 to 1000 pounds of Thomas Phosphate per acre on old gardens for new soil life.

Lesson 43.

CORN FORMULA.

Materials	Lbs.	Phos. Acid	Ammo.	Potash	Cost
Acid Phosphate	1000	160	----	----	$ 7.00
Nitrate of Soda	200	----	36	----	4.80
Tankage	400	24	40	----	8.80
Muriate of Potash	400	----	----	200	8.00
	2000	20) 184	76	200	$28.60
		9%	3.8%	10%	

Application of this mixture: Use from 200 to 400 pounds of this mixture per acre in drill before planting. When corn is 12 to 20 inches high use 400 to 600 pounds as side dresser. When corn bunches for tassel use 100 pounds Nitrate of Soda as a side dresser.

CORN FORMULA.

Materials	Lbs.	Phos. Acid	Ammo.	Potash	Cost
Acid Phosphate	1000	160	----	----	$ 7.00
Nitrate of Soda	200	----	36	----	4.80
Cottonseed Meal	600	15	45	9	7.80
Muriate of Potash	200	----	----	100	4.00
	2000	20) 175	81	109	$23.60
		8%	4%	5%	

Application of this mixture: Use from 200 to 400 pounds per acre in drill before planting. When corn is 12 to 20 inches high use 400 to 600 pounds as a side dresser. When corn bunches for tassel use 100 pounds Nitrate of Soda as a side dresser.

CORN FORMULA.

Materials	Lbs.	Phos. Acid	Ammo.	Potash	Cost
Acid Phosphate	1000	160	----	----	$ 7.00
Cottonseed Meal	800	20	60	12	10.40
Muriate of Potash	200	----	----	100	4.00
	2000	20) 180	60	112	$21.40
		9%	3%	5%	

Application of this mixture: Use 400 pounds in drill, per acre before planting. When corn is 12 to 20 inches high use 400 to 600 pounds per acre as a side dresser. When corn bunches for tassel use from 100 to 200 pounds Nitrate of Soda per acre as a side dresser.

Lesson 44.

COTTON FORMULA.

Materials	Lbs.	Phos. Acid	Ammo.	Potash	Cost
Acid Phosphate	1000	160	----	----	$ 7.00
Cottonseed Meal	800	20	60	12	10.40
Muriate of Potash	200	----	----	100	4.00
	2000	20) 180	60	112	$21.40
		9%	3%	5%	

Application for this mixture: Use 600 pounds per acre in drill before planting. Use 400 pounds per acre as side dresser when cotton is 6 or 8 inches high. Use 100 pounds of Nitrate of Soda per acre as side dresser when cotton begins to bloom.

COTTON FORMULA.

Materials	Lbs.	Phos. Acid	Ammo.	Potash	Cost
Acid Phosphate	1000	160	----	----	$ 7.00
Nitrate of Soda	200	----	36	----	4.80
Cottonseed Meal	600	15	45	9	7.80
Muriate of Potash	200	----	----	100	4.00
	2000	20) 175	81	109	$23.60
		8%	4%	5%	

Application of this mixture: Use 600 pounds of this mixture per acre in drill before planting. Use 400 pounds as side dresser when cotton is 6 to 8 inches high. Use 100 pounds Nitrate of Soda as side dresser when cotton begins to bloom.

COTTON FORMULA.

Materials	Lbs.	Phos. Acid	Ammo.	Potash	Cost
Acid Phosphate	1000	160	----	----	$ 7.00
Nitrate of Soda	200	----	36	----	4.80
Dried Blood	275	----	44	----	8.93
Kainit	525	----	----	63	3.15
	2000	20) 160	80	63	$23.88
		8%	4%	3%	

Application of this mixture: Use 600 pounds per acre in drill before planting. Use 400 pounds per acre as side dresser when cotton is 6 to 8 inches high. When cotton begins to bloom use 100 pounds of Nitrate of Soda as a side dresser.

Lesson 45.

CORN OR COTTON FORMULA.

Materials	Lbs.	Phos. Acid	Ammo.	Potash	Cost
Acid Phosphate	918	147	----	----	$ 5.50
Nitrate of Soda	100	----	18	----	2.75
Fish Guano	200	13	22	----	4.00
Muriate of Potash	80	----	----	40	1.60
	1298	20) 160	40	40	$13.85
		8%	2%	2%	

Application of this mixture: Use from 1000 to 1298 pounds per acre at different applications. Follow the same when crop is removed, with heavy application of lime and winter cover crop.

TOBACCO FORMULA.

Materials	Lbs.	Phos. Acid	Ammo.	Potash	Cost
Acid Phosphate	1000	160	----	----	$ 6.00
Nitrate of Soda	100	----	18	----	2.75
Dried Blood	262	----	42	----	7.86
Sulfate of Potash	120	----	----	60	2.90
	1482	20) 160	60	60	$19.51
		8%	3%	3%	

Application of this mixture: Use from 400 to 741 pounds per acre in drill before transplanting.

TOBACCO FORMULA.

Materials	Lbs.	Phos. Acid	Ammo.	Potash	Cost
Acid Phosphate	800	128	----	----	$ 4.80
Nitrate of Soda	200	----	36	----	5.50
Cotton Seed Meal	700	17	52	10	10.55
Sulfate of Potash	300	----	----	150	7.20
	2000	20) 145	88	160	$28.00
		7%	4%	8%	

Application of this mixture: Use from 600 to 1000 pounds per acre in drill before transplanting.

TOBACCO FORMULA.

Materials	Lbs.	Phos. Acid	Ammo.	Potash	Cost
Acid Phosphate	800	128	----	----	$ 4.80
Nitrate of Soda	200	----	36	----	5.50
Cotton Seed Meal	600	15	45	9	9.00
Sulfate of Potash	400	----	----	200	9.60
	2000	20) 143	81	209	$28.90
		7%	4%	10%	

Application of this mixture: Use from 800 to 1000 pounds per acre in drill before transplanting.

ACRE FORMULAS.

Lesson 46.

Crimson Clover	400 pounds Thomas Phosphate, 100 " Ground Bone, 100 " Muriate of Potash, 50 " Nitrate of Soda, One acre bottle Farmogerm.
Corn	400 pounds Thomas Phosphate, 100 " Nitrate of Soda, 100 " Muriate of Potash, 400 " Tankage or Fish Guano.
Barley	400 pounds Thomas Phosphate, 50 " Nitrate of Soda, 100 " Muriate of Potash, 100 " Ground Bone.
Millet	400 pounds Thomas Phosphate, 150 " Nitrate of Soda, 100 " Muriate of Potash, 300 " Cottonseed Meal.
Wheat	400 pounds Thomas Phosphate, 100 " Ground Bone, 100 " Muriate of Potash.
Oats	400 pounds Thomas Phosphate, 200 " Cottonseed Meal, 100 " Ground Bone, 100 " Muriate of Potash.
Soy Beans	400 pounds Thomas Phosphate, 200 " Cottonseed Meal, 100 " Muriate of Potash, 50 " Nitrate of Soda. One acre bottle Farmogerm.

Lesson 47.

Strawberries	400 pounds	Thomas Phosphate,
	200 "	Nitrate of Soda,
	200 "	Muriate of Potash,
	400 "	Fish Guano.
Dewberries	400 pounds	Thomas Phosphate,
	200 "	Nitrate of Soda,
	200 "	Muriate of Potash,
	400 "	Cottonseed Meal.
Irish Potatoes	400 pounds	Thomas Phosphate,
	200 "	Nitrate of Soda,
	200 "	Sulfate of Potash,
	400 "	Cottonseed Meal.
Lettuce	400 pounds	Thomas Phosphate,
	200 "	Nitrate of Soda,
	400 "	Dried Blood,
	200 "	Sulfate of Potash.
Celery	400 pounds	Thomas Phosphate,
	300 "	Nitrate of Soda,
	200 "	Sulfate of Potash,
	400 "	Fish Guano.
Tobacco	400 pounds	Acid Phosphate,
	100 "	Nitrate of Soda,
	300 "	Dried Blood,
	200 "	Sulfate of Potash.

Lesson 48.

Sweet Potatoes	200	pounds Thomas Phosphate,
	200	" Cottonseed Meal,
	50	" Nitrate of Soda,
	100	" Sulfate of Potash.
Cane	200	pounds Thomas Phosphate,
	100	" Nitrate of Soda,
	200	" Cottonseed Meal,
	100	" Sulfate of Potash.
Turnips	200	pounds Thomas Phosphate,
	100	" Nitrate of Soda,
	200	" Fish Guano,
	100	" Sulfate of potash.
Tomatoes	400	pounds Thomas Phosphate,
	200	" Nitrate of Soda,
	200	" Cottonseed Meal,
	100	" Muriate of Potash.
Cabbage	400	pounds Thomas Phosphate,
	200	" Nitrate of Soda,
	400	" Dried Blood,
	200	" Sulfate of Potash.
Cotton	400	pounds Thomas Phosphate,
	50	" Nitrate of Soda,
	100	" Muriate of Potash.
	400	" Cottonseed Meal.
Onions	400	pounds Thomas Phosphate,
	200	" Nitrate of Soda,
	400	" Cottonseed Meal,
	200	" Sulfate of Potash.

Lesson 49.

Rye
- 200 pounds Thomas Phosphate,
- 50 " Ground Bone,
- 100 " Muriate of Potash.

Cow Peas
- 400 pounds Thomas Phosphate,
- 50 " Nitrate of Soda,
- 100 " Muriate of Potash,
- One acre bottle Farmogerm.

Oats and Vetch
- 400 pounds Thomas Phosphate,
- 50 " Nitrate of Soda,
- 400 " Cottonseed Meal,
- 200 " Muriate of Potash,
- One acre bottle Farmogerm for Vetch.

Rye and Vetch
- 400 pounds Thomas Phosphate,
- 400 " Cottonseed Meal,
- 100 " Nitrate of Soda,
- 100 " Muriate of Potash,
- One acre bottle Farmogerm for Vetch.

Red Clover
- 400 pounds Thomas Phosphate,
- 100 " Bone Meal,
- 50 " Nitrate of Soda,
- 200 " Muriate of Potash,
- One acre bottle Farmogerm.

Rape
- 400 pounds Thomas Phosphate,
- 100 " Nitrate of Soda,
- 200 " Cottonseed Meal,
- 100 " Muriate of Potash.

Alfalfa
- 1000 pounds Thomas Phosphate,
- 200 " Nitrate of Soda,
- 400 " Dried Blood,
- 400 " Muriate of Potash,
- 2000 " Lime,
- One acre bottle Farmogerm.

Lesson 50.

Rye
- 50 pounds Ground Bone,
- 50 " Muriate of Potash,
- 200 " Acid Phosphate.

Cow Peas
- 200 pounds Acid Phosphate,
- 50 " Nitrate of Soda,
- 100 " Muriate of Potash,
- One acre bottle Farmogerm.

Oats and Vetch
- 400 pounds Acid Phosphate,
- 100 " Nitrate of Soda,
- 200 " Cottonseed Meal,
- 200 " Muriate of Potash,
- One acre bottle Farmogerm for Vetch.

Rye and Vetch
- 300 pounds Acid Phosphate,
- 200 " Cottonseed Meal,
- 100 " Nitrate of Soda,
- 200 " Muriate of Potash,
- One acre bottle Farmogerm for Vetch.

Red Clover
- 400 pounds Acid Phosphate,
- 100 " Ground Bone,
- 50 " Nitrate of Soda,
- 100 " Muriate of Potash,
- One acre bottle Farmogerm.

Rape
- 200 pounds Acid Phosphate,
- 200 " Nitrate of Soda,
- 200 " Cottonseed Meal,
- 100 " Muriate of Potash.

Alfalfa
- 800 pounds Acid Phosphate,
- 200 " Nitrate of Soda,
- 400 " Ground Bone,
- 400 " Muriate of Potash,
- 2000 " Lime,
- One acre bottle Farmogerm.

Lesson 51.

Sweet Potatoes	200	pounds Acid Phosphate,
	200	" Cottonseed Meal,
	50	" Nitrate of Soda,
	100	" Sulfate of Potash.
Cane	200	pounds Acid Phosphate,
	100	" Nitrate of Soda,
	200	" Cottonseed Meal,
	100	" Sulfate of Potash.
Turnips	200	pounds Acid Phosphate,
	200	" Nitrate of Soda,
	200	" Fish Guano,
	200	" Sulfate of Potash.
Tomatoes	200	pounds Acid Phosphate,
	200	" Nitrate of Soda,
	400	" Cottonseed Meal,
	200	" Muriate of Potash.
Cabbage	200	pounds Acid Phosphate,
	200	" Nitrate of Soda,
	400	" Dried Blood,
	200	" Sulfate of Potash.
Cotton	200	pounds Acid Phosphate,
	200	" Nitrate of Soda,
	100	" Muriate of Potash,
	400	" Cottonseed Meal.
Onions	200	pounds Acid Phosphate,
	200	" Nitrate of Soda,
	400	" Cottonseed Meal,
	200	" Sulfate of Potash.

Lesson 52.

Crimson Clover	200 pounds Acid Phosphate, 200 " Cottonseed Meal, 200 " Muriate of Potash, 50 " Nitrate of Soda, One acre bottle Farmogerm.
Corn	200 pounds Acid Phosphate, 200 " Nitrate of Soda, 100 " Muriate of Potash, 400 " Cottonseed Meal.
Barley	200 pounds Acid Phosphate, 50 " Nitrate of Soda, 100 " Ground Bone, 100 " Muriate of Potash.
Millet	200 pounds Acid Phosphate, 150 " Nitrate of Soda, 100 " Muriate of Potash, 200 " Cottonseed Meal.
Wheat	400 pounds Acid Phosphate, 100 " Ground Bone, 100 " Muriate of Potash.
Oats	400 pounds Acid Phosphate, 200 " Cottonseed Meal, 100 " Ground Bone, 100 " Muriate of Potash.
Soy Beans	400 pounds Acid Phosphate, 200 " Cottonseed Meal, 100 " Muriate of Potash, 50 " Nitrate of Soda, One acre bottle Farmogerm.

Lesson 53.

Peanuts	400 pounds Thomas Phosphate, 100 " Nitrate of Soda, 200 " Muriate of Potash, 200 " Cottonseed Meal, One acre bottle Farmogerm.
Cotton	400 pounds Thomas Phosphate, 400 " Tankage, 100 " Muriate of Potash, 100 " Nitrate of Soda.
Corn	400 pounds Thomas Phosphate, 400 " Tankage, 100 " Nitrate of Soda, 100 " Muriate of Potash.
Sugar Beets	400 pounds Thomas Phosphate, 200 " Nitrate of Soda, 200 " Sulfate of Potash, 400 " Tankage or Fish Guano.

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